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F2U

(54) Friction clutch driven plate

(57) A friction clutch driven plate comprises a hub assembly incorporating a hub (11) and two flanges (14 and 15) secured to the hub and extending therefrom. A friction member carrier (22) is arranged between the flanges and is capable of limited relative angular rotation with respect thereto. The carrier is coupled to the flange by damping springs (27). The carrier (22) has outwardly projecting teeth (35) which are engaged with inwardly directed teeth of an annular friction member (34). These teeth provide a drive between the carrier and friction member. Axial constraining means on the driven plate for the friction member are constituted by outward extensions (39 and 41) of the two flanges (14 and 15). The connection between the teeth allows transmission of drive from the friction member (34) to the carrier (22) without distorting the assembly by differential thermal expansion between the friction member and carrier.

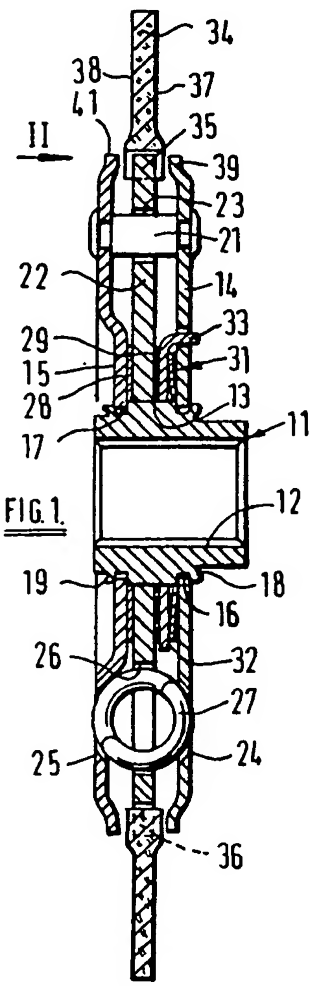

FIG. 1.

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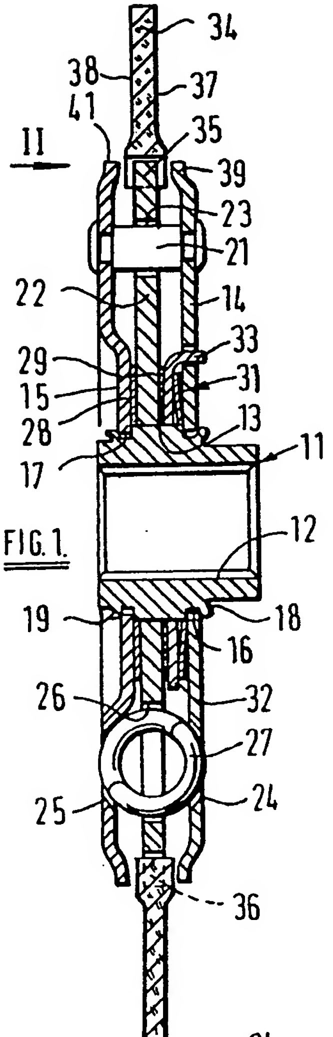

FIG. 1.

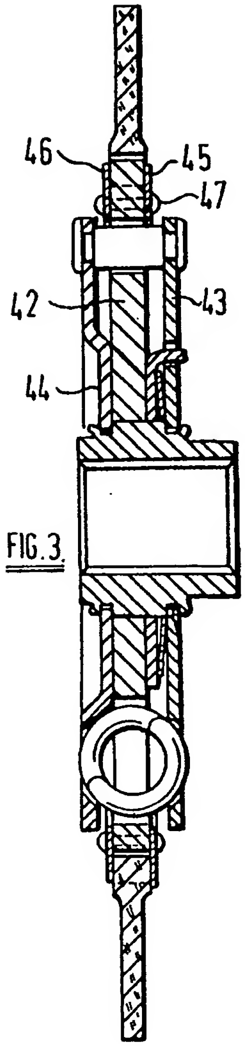

FIG. 3.

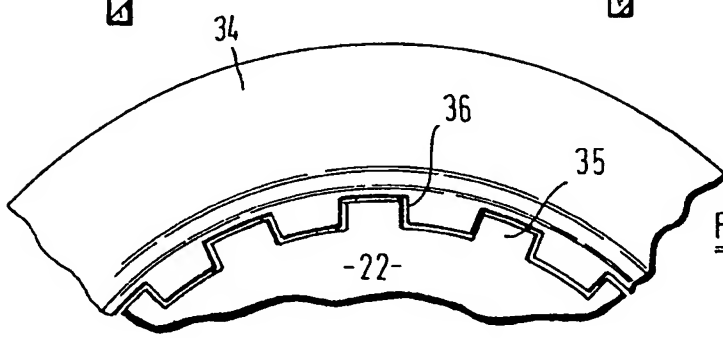

FIG. 2.

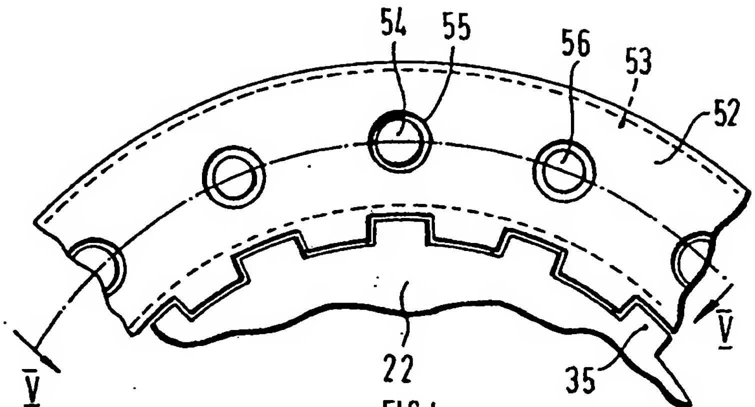

FIG.4.

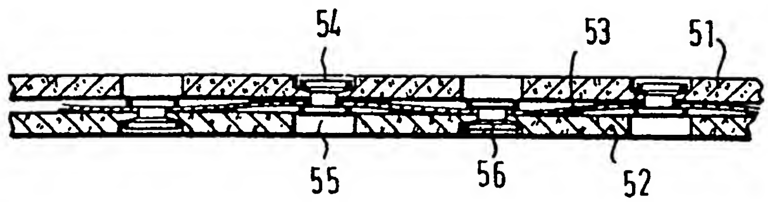

FIG.5.

SPECIFICATION

Friction clutch driven plate

The invention relates to friction clutch driven plates. Most conventional friction clutch driven plates incorporate two friction facings mounted one to either side of spring steel segments or a flexible steel disc by means of which the friction facings are mounted to inner parts of the driven plate. In most cases the mountings for the friction facings provide axial cushioning to assist smooth clutch engagement. It has also been proposed to use a friction member in the form of a single two-sided friction facing because this cuts down the weight requirement around the outer part of the driven plate and thus contributes substantially to a reduced moment of inertia. However, there have been difficulties associated with providing a satisfactory mounting of the friction member on the inner part of the driven plate and an object of the present invention is to provide an improved mounting, for a friction member, primarily but not exclusively a single two-sided friction facing.

In accordance with one aspect of the present invention there is provided a friction clutch driven plate comprising a hub assembly incorporating a hub and at least one flange extending therefrom; a friction member carrier arranged adjacent the flange, capable of limited relative angular rotation with respect thereto and coupled to the flange by resilient rotary drive means; wherein the friction member carrier is provided with outwardly extending teeth around its outer periphery, an annular friction member has corresponding inwardly directed teeth to engage with the teeth of the carrier and provide drive between the carrier and the friction member and axial constraining means are provided on the driven plate to retain the teeth of the friction member in engagement with the teeth of the carrier.

The carrier may comprise two plates coupled together to move in unison and arranged one to each side of the flange. Preferably the friction member extends inward between the flanges so that the flanges provide said constraining means. This arrangement provides particularly convenient axial location of the friction member. Alternatively, the carrier may extend outward beyond the outer periphery of the flanges in which case the constraining means comprises retainers secured to both sides of the intermediate plate.

Preferably the friction member is constituted by a solid piece of friction material having an outer part with two opposed annular friction faces and a widened inner part incorporating the inwardly directed teeth.

The friction member may alternatively comprise two friction facings mounted on a support and axial cushioning may be provided between the two facings.

A radial clearance may be provided in the toothed connection between the friction member and the carrier to allow relative radial expansion and contraction. In use, the friction member may be heated significantly above the temperature of the carrier in which case it expands radially. By providing for free relative expansion and contraction at the toothed connection, any tendency to produce distortion due to this expansion and contraction is reduced. The two opposed faces on each tooth of the carrier or of the friction member may be mutually parallel in order to prevent substantial clearance developing in the toothed connection during expansion of the friction member.

Alternatively a substantial clearance may be provided between the teeth of the friction member and those of the carrier to provide relative angular rotation therebetween and resilient drive means may be provided to control the relative rotation and thereby provide for damping of vibrations in the drive through the driven plate.

Preferably the friction member is constituted of a mineral-based essentially non-metallic friction material. The driven plate is intended for use in a dry clutch, that is one without lubrication of friction faces, for that purpose an asbestos-based friction material is suitable. However, substitutes for asbestos-based materials which have been introduced to eliminate health risks from asbestos may also be suitable.

Embodiments of the invention will now be described by way of example only with reference to the accompanying drawings in which:–

Figure 1 is a cross-section through a clutch driven plate illustrating a first embodiment of the invention;

Figure 2 is a view in the direction of arrow II of Fig. 1 with some parts removed in the interests of clarity;

Figure 3 is a view corresponding to Fig. 1 showing a modification;

Figure 4 is a view corresponding to Fig. 2 but showing a modified friction member; and

Figure 5 is a section of line V–V of Fig. 4.

The friction clutch driven plate shown in Figs. 1 and 2 incorporates a hub 11 having internal splines 12 to enable the hub to drive a gearbox input shaft. The hub is generally cylindrical with a projecting boss 13 remote from its two ends. Two annular side plates 14 and 15 are secured to the hub 11 at the extremities of the boss 13 so that they form two mutually spaced flanges which together with the hub 11 form a hub assembly. In this example, the inner edges of the side plates 14 and 15 have sets of inwardly directed teeth 16 and 17 which bite into shoulders at the edges of the boss 13 and are then more positively located by deforming these shoulders as illustrated at 18 and 19. The outer

parts of the side plates or flanges 14 and 15 are also held in the required mutually spaced relationship by large shouldered rivets 21 which serve another purpose to be described subsequently and are normally referred to as stop pins. The hub assembly as thus far described is in practice assembled around other parts of the driven plate which are now to be described.

A friction member carrier constituted primarily by an intermediate annular plate 22 is arranged between the side plates 14 and 15 and in itself is freely rotatable on the boss 13. The intermediate plate 22 has circumferentially elongated apertures 23 through which the stop pins 21 extend. The length of these apertures limit the extent of relative angular rotation possible between the hub assembly and the friction member carrier. Side plates 14 and 15 and intermediate plate 22 also have a series of aligned rectangular spertures 24, 25 and 26 and a circumferentially directed coil spring 27 is arranged in each such set of aligned apertures. These springs provide a resilient rotary drive means between the hub assembly and the friction member carrier.

Between the inner parts of the side plates 14 and 15 and the intermediate plate 22 there is a conventional friction system for providing frictional resistance to movement between the hub assembly and carrier. This consists of two friction washers 28 and 29, one to each side of the intermediate plate and a belville spring 31 reacting on side plate 14 and causing a bearing washer 32 to load the friction washers 28 and 29 axially. Bearing washer 32 has at least one tongue 33 engaged in side plate 14 to ensure that it rotates therewith.

The invention is concerned with the nature of the mounting of a friction member on the friction member carrier, in this example the mounting of a single facing 34, on the intermediate plate 22.

The outer periphery of intermediate plate 22 carries a series of radially directed teeth 35 and these engage with a corresponding series of inwardly directed teeth 36 on the annular friction facing 34. The form and the engagement of these teeth is most readily seen on Fig. 2. The opposed drive faces of each tooth 35 are parallel to each other rather than being strictly radial and considering a recess between teeth rather than a tooth itself of the friction facing 34, the two drive faces are correspondingly parallel. This arrangement provides that in the event of differential expansion between the intermediate plate and the friction facing, the radial expansion of the friction facing does not result in a significant increase in circumferential clearance between teeth which may otherwise introduce an undesired freedom for relative rotation. A positive circumferential clearance is shown in Fig. 2 in the interests of clarity but in practice the circumferential clearance should be as small as possible. There is however a deliberate radial clearance between the intermediate plate and friction facing at the toothed connection 35, 36 to ensure that on differential expansion between the carrier and facing, these two components do not load each other in such a way as might cause distortion.

The friction member 34 is constituted by a solid piece of friction facing material as is normally used in dry friction clutches. In the interests of providing sufficient strength for the teeth 36, the inner periphery of the friction facing is widened as shown in Fig. 1 while the outer part of the facing has two opposed friction faces 37 and 38.

In order to hold the friction facing 34 axially on the teeth 35, the two side plates 14 and 15 extend out beyond the inner periphery of the friction facing and have inwardly turned edges 39 and 41 to provide axial constraining means with a small clearance for axial float of the facing.

The embodiment shown in Fig. 3 corresponds in most respects to that shown in Figs. 1 and 2. However, the intermediate plate 42 is thicker than the corresponding plate of Fig. 1 so that it confirms to the thickness of the inner part of the friction facing. The friction washers 28 and 29 of Fig. 1 are also omitted. The side plates 43 and 44 are of smaller external diameter than the corresponding side plates 14 and 15 so that the friction facing can be slid axially on and off the intermediate plate 42 with the main parts of the driven plate assembled. Instead, the friction facing is held on to the intermediate plate 42 by small retainer plates 45 and 46 secured to the intermediate plate 42 by rivets 47. The arrangement of Fig. 3 is more expensive to produce than that of Fig. 1 in view of the additional components and rivetting operations but it does enable the friction facing to be replaced after it has worn or become damaged without dismantling the whole of the driven plate.

In a modification, instead of arranging for the teeth 35 to have mutually parallel faces, the teeth 36 of the friction facing may have parallel faces in which case the recesses between teeth on the carrier have correspondingly parallel faces.

Because the friction member is a single friction facing in place of the two friction facings provided on most conventional single dry plate clutches, the driven plate can be designed to have a low moment of inertia. Also, as friction facings constitute a large part of the cost of a driven plate the total cost can be relatively low.

However, in a further modification the friction member may be constituted by two friction facings mounted on a support and the support may incorporate or be provided with

cushioning means to cushion the clamping of the driven plate during use.

Such an arrangement is illustrated in Figs. 4 and 5 which show a modified form of friction member. Fig. 4 is a view corresponding to Fig. 2 but showing the modified friction member only. The friction member comprises two friction facings 51 and 52 (see Fig. 5) and a spring steel support 53 interposed between the facings. Element 53 is slightly corrugated so that it spaces the facings 51 and 52 apart by a distance greater than its own thickness and provides a cushioning means as the two friction facings are clamped together during take-up of drive through a friction clutch incorporating the driven plate. Friction facing 51 is mounted on the element 53 by a series of recessed rivets 54. Each of these rivets is countersunk into the facing 51 and is in register with an opening 55 in the facing 52 to provide access to and clearance for the rivet. Rivets 54 are arranged at positions where the facing 51 is in contact with the element 53.

Similar rivets 56 arranged in a similar way secure the friction facing 52 to the support 53 so that in effect the two facings 51 and 52 are secured together through the intermediary of the support 53. Both elements 51 and 52 have inwardly directed teeth as shown in Fig. 4 and these teeth engage with the teeth 35 of the intermediate plate 22. The toothed connection thus provides a drive between the two facings of the friction member and the intermediate plate 22.

The teeth 35 and 36 in Fig. 2 and the corresponding teeth in Fig. 4 are shown to be of substantially equal circumferential dimensions. However, a wide variety of variations of toothed interconnection could be provided as alternatives. For example, the circumferential extent of one set of teeth could be increased compared with that of the other set to the extent where the teeth become a small number of projections from one member engaging in corresponding recesses in the other member. Also, although the parallel sided teeth are preferred, other tooth shapes providing flat or curved engagement surfaces may be employed.

In a still further modification, the two flanges 14 and 15 and intermediate plate 22 may be replaced by a single central flange and the two side plates coupled together to move in unison and form the friction member carrier.

CLAIMS

1. A friction clutch driven plate comprising a hub assembly incorporating a hub and at least one flange extending therefrom; a friction member carrier arranged adjacent the flange, capable of limited relative angular rotation with respect thereto and coupled to the flange by resilient rotary drive means; wherein the friction member carrier is provided with outwardly extending teeth around its outer periphery and an annular friction member has corresponding inwardly directed teeth to engage with the teeth of the carrier and provide drive between the carrier and the friction member and axial constraining means on the driven plate are provided to retain the teeth of the friction member in engagement with the teeth of the carrier.

2. A friction clutch driven plate as claimed in claim 1 wherein the carrier comprises two plates coupled together to move in unison and arranged one to each side of the flange.

3. A friction clutch driven plate as claimed in claim 1 wherein the hub has two mutually spaced flanges extending therefrom and the friction member carrier is arranged between the flanges.

4. A friction clutch driven plate as claimed in claim 3 wherein the friction member extends inward between the flanges so that the flanges provide said constraining means.

5. A friction clutch driven plate as claimed in claim 3 wherein the intermediate plate extends outward beyond the periphery of the flanges and the constraining means comprises retainers secured to both sides of the intermediate plate.

6. A friction clutch driven plate as claimed in any one of the preceding claims wherein the friction member is constituted by a solid piece of friction material having an outer part with two opposed annular friction faces and a widened inner part incorporating the inwardly directed teeth.

7. A friction clutch driven plate as claimed in any one of claims 1 to 5 wherein the friction member comprises two friction facings mounted on a support.

8. A friction clutch driven plate as claimed in claim 7 wherein axial cushioning is provided between the two facings.

9. A friction clutch driven plate as claimed in any one of the preceding claims incorporating a radial clearance in the toothed engagement between the friction member and the intermediate plate to allow relative radial expansion and contraction of the intermediate plate and friction member.

10. A friction clutch driven plate as claimed in claim 9 wherein the opposed faces of each tooth of the intermediate plate or the friction member are mutually parallel.

11. A friction clutch driven plate as claimed in any one of the preceding claims incorporating a substantial circumferential clearance between the teeth of the friction member and the teeth of the intermediate plate to provide relative angular rotation therebetween and resilient drive means controlling the relative rotation and providing for damping of vibrations in the drive through the driven plate.

12. A friction clutch driven plate as

claimed in any one of the preceding claims wherein the friction facing is constituted of a non-metallic mineral-based friction material.

13. A friction clutch driven plate substantially as described with reference to and as illustrated by any of the figures of the accompanying drawings.

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